Periodicals of Engineering and Natural Sciences ISSN 2303-4521
Vol..8., No.3, September 2020, pp.1847-1859

A critical analysis of absorptive capacity research

Chams Eddoha Mokhlis [1], Nada Soudi [2], Hajar Mouatassim Lahmini [3], Asmaa Elmortada[4]
[1]Laboratory of Scientific Engineering of Organizations, National School of Commerce and Management (ENCG) Casablanca, Hassan II University, Morocco
[2] Department of management, Institut Supérieur de Commerce et d'Administration des Entreprises, Casablanca, Morocco
[3] Department of management, National School of Commerce and Management, Casablanca, Hassan II University, Morocco
[4]Process Signaux Système Industriel et Informatique Laboratory, Cadi Ayad University, Marrakech, Morocco

ABSTRACT

The ability to absorb new external knowledge (ACAP) becomes a major source of innovation and competitive advantage. Despite the abundance of literature devoted to this concept, it remains shrouded in conceptual and empirical confusion. In this paper, we will attempt to shed light on this construct. Based on a thematic analysis of this literature, we identify five main themes covered by absorptive capacity research, such as: conceptualizations of ACAP, dimensions, measurement scales, main antecedents and organizational outputs of ACAP. The results show that, despite the efforts made in this field, the variety of conceptualizations, the diversity of measures used, the focus on "Content" of knowledge at the expense of "Processes", "IT Systems" and "Context" of their integration, restrict our understanding of this concept. The paper then addresses some limitations of that works, and discusses avenues for future researches.

Keywords: Absorptive capacity, measurement scales, knowledge management processes innovation, Organizational outputs.

Corresponding Author:

Chams Eddoha MOKHLIS,
Departement of management
Ecole Nationale de Commerce et de Gestion, ENCG
Hassan II University
Address: Beau site B.P 2725 Ain Sebaâ , Casablanca
2725 Route des Chaux et Ciments, Casablanca 20250, Morroco
Email: chams.mokhlis@gmail.com
ORCID code: https://orcid.org/0000-0001-8009-7401

1. Introduction

In front of the turbulences of the economic environment, the increase of the competition and the acceleration of the technological progress, companies must be more agile and open to change. These changes require the development of new knowledge, soft skills, adaptive capacity and innovation. The knowledge-based view of the firm (KBV) considers knowledge as the most strategically precious resource of a firm. Its partisans plead that because knowledge-based resources are difficult to imitate and relatively immobile, heterogeneous knowledge bases and capabilities among firms constitutes the basis for a sustainable competitive advantage and superior performance [1] – [2].

This competitive advantage is reflected, among other things, by the development of skills to identify, assimilate and exploit external knowledge likely to benefit from promising innovations. These skills are qualified, for the first time, in the work of [3], under the concept of the capacity to absorb external knowledge. Since the publication of the seminal article by [3], the absorptive capacity construct (ACAP) has been extensively reinvested in research on organizational learning, knowledge management, open innovation or strategic management. Despite the abundance of this research, the diversity of conceptualizations, the lack of

consensus on the dimensions of ACAP and the variety of operational measures used [4] - [5], limit our knowledge of this concept.

The aim of this paper is to explore the absorptive capacity construct. A thematic analysis of the key papers in the field, allowed us to identify five broad themes and to structure our absorptive capacity review around those topics. Finally, to conclude, we will develop the limits of this research and the considered extensions.

2. Materials and methods

Our study aims to answer the following research questions: what is ACAP? How can it be defined? What are its different dimensions? How can it be measured? What are its antecedents and impacts? To answer these questions, we conducted a thematic analysis of the literature. Thematic content analysis is a method of searching for the subjective interpretation of the content of a text's data through a process of systematic classification, coding and identification of themes or patterns [6]. Our analysis of the literature took place in two steps. First, we have made a selection of the key articles in the field of strategic management and entrepreneurship journals, like Academy of Management Review, Academy of Management Journal, Administrative Science Quarterly, and Strategic Entrepreneurship Journal. We have chosen article search keywords such as absorption capacity, knowledge management, from 1990 to 2019, and then we coded the selected articles according to the five themes identified.

3. Results

A thematic analysis of literature allowed us to identify five main themes covered by absorptive capacity research: (1) Conceptualizations, (2) Dimensions, (3) Operational measures, (4) Main antecedents and finally (5) Organizational outputs of ACAP.

3.1. Conceptualizations of ACAP

The concept of absorptive capacity (ACAP) has its origins in macroeconomics. It refers to the capacity of an economy to use and absorb information and external resources [7]. Cohen and Levinthal [3] have adapted this concept to organizations and defined it as a firm's ability to: *"[…] recognize the value of new, external information, assimilate it, and apply it to commercial ends […]",* "Ref. [3]: p.128". This capacity contains three components: (1) the capacity to recognize the value of new information, (2) the capacity to assimilate them and (3) the capacity to apply them for the commercial purpose of the firm. It depends on the individual absorptive capacities of its members, but it is not simply equal to the sum of these individual absorptive capacities.

The way in which the concept has been defined and used is very heterogeneous. Cohen and Levinthal's definition has been widely adopted by authors interested in this line of research [4] - [8].With the development of the concept and the promotion, it has known within the research community, other definitions have emerged and have highlighted other facets of this concept. "Ref. [9]" suggested that in the context of knowledge transfer within multinational companies, the organization's absorptive capacity should be made up of the capacity of its employees and motivation.

Following on from the work of [3], Zahra and George [10] postulated that absorptive capacity is a dynamic capability which influences the nature and sustainability of a company's competitive advantage, thus improving the economic performance. They define it as "*a set of organizational routines and processes by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability",* "Ref. [10]: p.186". These organizational capabilities can be grouped into potential absorptive capacity (capacity to acquire and assimilate knowledge) and the absorptive capacity achieved (capacities for transforming and exploiting knowledge). The potential absorptive capacity does not guarantee the exploitation of the acquired knowledge.

Since its publication in 2002, the study conducted by [10], remains one of the studies that has had the most impact on literature in this line of research, and has been mobilized by several researchers [11] -[5]- [12]. It

should be noted that the definition of [10] has sparked debate due, among other things, to its omission of the first dimension of absorptive capacity (namely: recognizing the value of knowledge) as proposed in the original model of [3]. "Ref. [8]" pointed to several criticisms of the model of [10]. On the one hand, they considered that the conceptualization of the absorptive capacity proposed by these authors omits the dimension of recognizing the value of knowledge. For them, this oversight thwarts the strategic nature of the concept and they suggested reintegrating it. To better understand the multidimensional nature of ACAP, we will define, in the next section, the dimensions of this concept as proposed in the literature.

3.2. Dimensions of absorptive capacity

Our analysis of the literature revealed five complementary and chronological dimensions of ACAP: identification and recognition of the value, knowledge acquisition, assimilation, transformation and exploitation. First of all, note that a literature review, carried out by [4] of 289 articles having as main theme the concept of the absorptive capacity, highlighted that very few studies approaching this concept from its dimensions. Indeed, these authors have been known that more than 35% of this work does not mention any of the three dimensions of ACAP as they appear in the model of [3].

3.2.1. Identify or recognize the value of knowledge

"Ref. [13]" considered that external sources of knowledge are essential to the innovation process. Thereby, the absorptive capacity depends on the ability to recognize the value of external information. This dimension highlights the strategic nature of the absorptive capacity in the pursuit of relevant knowledge that can maintain or develop a competitive advantage for the company. For "Ref. [3]", the ability to recognize the value of information depends on prior knowledge and investments. According to them, it is by investing more in R&D that the firm improves its absorptive capacity and at the same time, its ability to recognize the value of knowledge. Few empirical studies have taken this dimension into account, despite its importance. The analysis of this work showed that the operationalization of this dimension was rather adapted to the context of application of the study. For example: in examining absorptive capacity in a dyadic learning context, "Ref. [14]" operationalized this dimension based on the relevance of knowledge that is transferred. "Ref. [15]" measured firms' ability to identify and assess relevant knowledge through their R&D expenditures. For "Ref. [8]", what influences the organizational capacity to identify relevant information is the attention. According to them, this dimension deserves to be invested from the angle of attention-based view.

3.2.2. Acquire knowledge

This dimension was introduced by [10], as the first dimension of absorptive capacity. According to them, it refers to a firm's ability to identify and acquire external knowledge that is essential to its performance. Knowledge acquisition has often been used to replace knowledge identification dimension [11], [16] Knowledge acquisition is also influenced by prior knowledge and previous R&D investments. In addition, there are other factors such as motivation and effort to acquire knowledge, intensity, speed and the chosen direction [10]. Despite its importance, little empirical research has taken this dimension into account. In the context of joint venture, the study that was conducted by [17] revealed that investment in the formation of the joint venture is positively associated with its level of knowledge acquisition of the foreign parent company. The study of [11] showed that the acquisition of knowledge is influenced by the coordination capacities of the firm measured by three dimensions: inter-functional exchange interfaces, staff participation and rotation as well as systems facilitating knowledge integration (formalization) and the implementation of organizational routines (routinization).

3.2.3. Assimilate knowledge

"Assimilation refers to the firm's routines and processes that allow it to analyze, process, interpret and understand information obtained from external sources", "Zahra and George [10]: p.189". Understanding,

analyzing and interpreting knowledge more mobilizes the basic abilities of individuals such as their basic training, their experience or their motivation to learn new knowledge. Very few studies have empirically explored this dimension. As an example: "Ref. [14]" attempted to measure knowledge assimilation in a dyadic learning context (between two firms), using the similarity between the two firms in terms of their managerial functions. This similarity is expressed, according to them, through the degree of formalization of tasks, centralisation practices and compensatory practices. In the same perspective, the results of the quantitative study conducted by [11] showed that, on the organizational level, assimilation is influenced by exchange interfaces (cross-functional interfaces) and connection mechanisms (connectedness).

3.2.4. Transforming knowledge

It was Zahra and George who introduced transformation as an additional dimension to the conceptualization of absorptive capacity by [3]. They defined it as "*Transformation denotes a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge"*, "Ref. [10]: p. 190". For these authors, the transformation takes place by adding or removing knowledge or interpreting existing knowledge in a different way. It has two components: internalization and conversion. Zahra and George proposed to measure the effect by the number of ideas or research projects centered on new products. In criticizing the work of [10], "Ref. [8]" presented this dimension as an alternative step to assimilation and not as a separate dimension of absorptive capacity.

In addition to the lack of theoretical consensus around the relevance of this dimension, it has not been much explored empirically. For example: the study conducted by [11], found that the transformation is influenced by three organizational variables: the firm's coordination capabilities; systems capabilities and finally, socialization capabilities. More recently, the qualitative study carried out by [18], among 5 health biotechnology companies showed that the transformation of knowledge is positively and significantly influenced by "relational capital" and the establishment of "knowledge integration mechanisms". According to respondents, this dimension is mainly based on formal and informal discussions with customers, but also with line managers, consultants and other partners. They stated that they regularly formalized research results for their clients and discussed the implications of these results with them.

3.2.5. Exploiting knowledge

Exploitation refers to the firm's ability to apply new external knowledge to commercial ends [3]. For "Ref. [10], p. 190": « *Exploitation as an organizational capability is based on the routines that allow firms to refine, extend, and leverage existing competencies or to create new ones by incorporating acquired and transformed knowledge into its operations [...] »*. These authors proposed to measure the effect by the number of patents or announcements of new products.

Unlike other dimensions of absorptive capacity, knowledge exploitation has been the subject of numerous studies [13]. For Jansen et al. [11], the organization's capability to exploit knowledge is influenced by the availability of formalization mechanisms, connection mechanisms and socialization tactics. In addition, in order to explore the specificities of the ACAP process, "Ref. [18]" conducted an in-depth qualitative study of five health biotechnology companies. The results demonstrated that several important aspects characterize the knowledge absorption process implemented within these five companies. On the one hand, they confirm the multidimensional, cumulative and interactive nature of this process. On the other hand, they highlight the uncertain, iterative and nonlinear nature of the absorption process.

Based on the literature [13] - [15] - [8], we postulate that the knowledge absorption process is an iterative and cumulative process which is carried out according to four processes, namely: Acquisition: refers to the ability of the business to identify and acquire relevant external knowledge. Assimilation: refers to the capability of these companies to analyze, understand and interpret the knowledge acquired. Transformation: refers to the firm's capability to develop routines that facilitate the combination of existing knowledge with newly acquired

and assimilated knowledge. Exploitation: refers to the firm's capability to apply new knowledge to achieve its organizational goals.

3.3. Main antecedents of absorptive capacity

Our literature review revealed that few theoretical and empirical studies have focused on the antecedents of ACAP. Huang et al.,[19] have conducted a quantitative study to test the hypotheses of [3]. The results showed that investments in R&D develop ACAP and stimulate business innovation. In addition to the largely highlighted contribution of knowledge and prior investments in R&D, the literature on absorptive capacity embraced new conceptualizations.

"Ref. [10]" argued that the use of social integration mechanisms reduces the gap between potential absorption capacity (PACAP) and realized absorption capacity (RACAP) and improves the efficiency of knowledge exploitation. As an extension of this work, "Ref. [11]" made distinction between the antecedents of potential and realized ACAP. The results of their research indicated that organizational mechanisms related to coordination capabilities (cross-functional interfaces, participation, and job rotation) mainly improve potential absorptive capacity, while organizational mechanisms associated with socialization capabilities (connectedness and socialization tactics) reinforce realized absorptive capacity. In the same way, the study conducted by [20] found that organizational characteristics such as decentralization, normative integration and innovative organizational culture, strengthens ACAP in the subsidiaries of multinational companies.

Furthermore, "Ref. [21]" demonstrated that relational embeddedness and relational empowerment develop firms' ACAP. More recently, the study conducted by [22] showed that using information and communication technologies as a learning tool enhances ACAP and increases the performance. By adopting the level of team analysis, "Ref. [23]" argued that the development of team ACAP is influenced by the similarity of work methods and complementarity knowledge. The study conducted by [18], highlighted the impact of leadership, relational capital, actors' cognitive capacities, organizational flexibility, knowledge integration mechanisms and IT systems on the different dimensions of the ACAP process.

Several studies have been interested in the determinants of absorptive capacity. Our investigation of the literature showed that absorptive capacity is influenced by internal and external factors. Internal factors include for example: the base of prior knowledge, the absorptive capacity of individuals, staff education level and motivation, organizational structure, firm size, cross-functional communication, culture, strategy, investment in R&D and human resources management [9]- [16]- [5] - [23] - [24]. External factors include: the external knowledge environment, position in the knowledge network and relational capital, resemblance of organizational structures and shared research communities [14] - [24] - [17] - [13] - [15].

The (table1) offer a classification of the internal and external factors analyzed in different empirical studies by mobilizing three levels of analysis: intra-organizational, organizational and inter-organizational.

Table 1. Antecedents of absorptive capacity

Types of factors	Level of Analysis	Background Examples	Reference
- Internal factors	- Intrafirm level	- Unit R&D investment intensity - knowledge flow configuration - Staff education level and motivation - diversity of staff experiences - Similarity of certain attributes (sharing similar common language) and knowledge complementarity.	Cohen et Levinthal (1990-2015), Tsai (2001), Minbaeva & Michailova (2004) Van Den Bosh et al . (2005); Backmann et al. (2015)
	- Firm level	- Prior related knowledge : depth and diversity - knowledge complementarily - Investment in R&D and training	Zahra et George (2015); Daghfous (2004); Van Den Bosh et al . (2005); Jansen et al., (2005).

		- Organizational structure: decentralization, normative integration, size of the firm, - Combinative capabilities: (Systemic, coordination and socialization capabilities) - Information and communication technologies. - Leadership: Strategic vision - Innovative culture	Ebers and Maurer (2014) Huang et al (2015); Mokhlis et al.(2019 a); Lane et al. (2006); Schleimer & Pedersen (2013).
- External Factors	- Interfirm level	- Turbulences of the environment - Scientific and technological opportunities - Specific type of new knowledge - Similarity of capabilities compensation practices and organizational structures - familiarity with organizational problems - Shared research communities - Relational capital (business and research networks) - Position in the knowledge network	Liao et al.(2003);Arbussa & Coenders (2007);Phan et al., (2006); Tsai (2006); Cohen & Levinthal (2015); Zahra & George (2015); Mokhlis (2014); Lane & Lubatkin (1998), Murovec &Prodan (2009); Lichtenthaler (2009); Flatten et al(2011)

Source: Authors elaboration.

3.4. Operational measures of absorptive capacity

The literature review revealed that empirical studies mobilizing absorptive capacity rarely refer to all of its dimensions [4]. The majority of these studies considered this concept as an unidimensional variable. Most often, these studies proposed operational measures without necessarily relating them to the dimensions of the concept.

The most commonly used measures is related to the assessment of R&D expenditures relative to annual sales, patents owned, number of scientific publications, years of experience in the R&D department [13]- [26], while not all companies have an R&D department. These measures have limited the richness and scope of this concept. In other cases, the authors adapted the dimensions according to the context of the study. We can observe that other organizational processes and mechanisms within firms contribute significantly to the development of the innovation capacity of firms [11] - [27]. Beyond the links with R&D highlighted, our analysis of the literature showed that in recent years, few researchers based on the [10] model, have proposed different multidimensional scales of measurement [11] - [5] - [12].

Other authors demonstrated that external factors can be used to quantify the absorptive capacities of companies : such as external environment scanning and integrating external knowledge [28]- [29], relational capital (business and research networks), alliances, joint- ventures and acquisitions, position in the knowledge networks, intensity and quality of partnership relationships, exchange of information and knowledge, partners' work-style similarity and knowledge complementarity [14] - [17] -[30]- [15]-[13]- [18].

The study conducted by [11], remains the baseline empirical study on the operationalization of the conceptualization of ACAP. By exploring the determinants of absorptive capacity at the organizational level, this study showed that the acquisition of knowledge is influenced by the coordination capacities of the firm measured by three dimensions: the exchange interfaces (cross functional interface), staff participation and rotation as well as systemic mechanisms facilitating the implementation of organisational routines (routinisation), assimilation is influenced by cross-functional interface (interchange) and connection mechanisms (connectedness), transformation is influenced by the coordination capacities of the firm, the systemic capacities measured by the formalization and routinization mechanisms, and the socialization mechanisms measured by the socialization processes and the connection mechanisms.

Finally, for “Ref. [11]”, the capacity of the organization to exploit knowledge depended on the availability of formalization mechanisms, connection mechanisms (connectedness) and socialization. Based on these findings, “Ref. [30]” created two scales to measure the key components of ACAP: potential and

produced absorption capacities. In order to verify the validity of these scales, they conducted a confirmatory factor analysis on a sample of 952 Spanish companies. The results confirmed the validity of the scales proposed to measure the absorptive capacity. "Ref. [5]" evolved a multidimensional measure of ACAP, which has been validated through a series of pre-tests, and two large survey-based studies of German firms.
More recently, in order to explore and confirm the ACAP factors, as determined in the model of [10], "Ref. [12]" conducted an exploratory factor analysis (EFA) followed by Confirmatory factor analysis (CFA) based on a sample of 111 wine companies in Spain. The results showed that three factors are empirically proven to be in accordance with the theory: knowledge acquisition, assimilation and transformation. One other factor, knowledge exploitation, does not correspond with their empirical result. They concluded that using other indicators related to knowledge exploitation capabilities might lead to more fit research model.
Absorptive capacity has been the subject of other operational measures, such as the ones related to social capital, staff skills and motivation [9]-[32]-[5], relational embeddedness and relational empowerment [33]-[27], Information technology tools [22], organizational structure and knowledge integration mechanisms [16] - [11] - [33]- [31].

The Table (2) presents a summary of the different dimensions of absorptive capacity, specifying their determinants and their operational measures.

Table 2. Dimensions, antecedents and operational measures of absorptive capacity according to the literature

Capacity dimensions	**Components**	**Antecedents**	**Measures**	**Citations**
- Identification and acquisition	- Prior investments	- R&D investments - Training	- Amount of investment in R&D - Amount of investment training	Cohen & Levinthal (2002-2015); Zahra & George (2002); Tsai (2001); Murovec & Prodan (2009); Huang et al., (2015).
	- Prior knowledge	- Knowledge base - Experiences of the R&D department	- Patents owned, number of scientific publications - Years of experience in the R&D department - Staff education level	Cohen & Levinthal (1991-2015);Tsai (2001);Todorova & Durisin (2007); Huang et al., (2015).
	- Commitment to knowledge acquisition	- Efforts to acquire knowledge - direction - Intensity - Speed	- Definition of learning objectives - The knowledge investment intensity - The speed of knowledge acquisition - External environment scanning - competitive intelligence system and integrating external knowledge	Cohen & Levinthal (2015); Zahra & George (2002) Lane et al. (2006); Tsai, (2006); Liao et al., (2003); Arbussa & Coenders (2007).

		- Combinative capabilities: (Systemic (IT), coordination and socialization capabilities).	- Coordination mechanisms: Cross-functional exchange interfaces, staff participation, rotation - Systemic mechanisms : formalization, routinization - Relational embeddedness and empowerment - Managerial IT knowledge processes and systems - Structure: flexibility, decentralization	Van Den Bosch et al., (2005); Iyengar et al.(2015); Jansen et al.,(2005); Pradana et al., (2019); Flatten et al. (2011); Ebers & Maurer (2014); Hughes et al. (2014); Mokhlis et al. (2019 b).
		- Relational capital	- Number of partners (Business and research networks, Alliances) - Position in the knowledge networks.	Lane et Lubatkin (1998);Tsai, (2006), Phan et al., (2006); Volberda et al. (2010); Mokhlis (2014)
- Assimilation	Comprehension Interpretation Formalization	- R&D investments - Investment in training	- Amount of investment in R&D - Amount of investment training	Cohen et Levinthal (1990); Lane et Lubtakin (1998); Zahra et George (2002).
		- Knowledge base - Experiences of the staff	- Number of citations made in publications of a research company developed in other companies. - Years of experience in the R&D department, - Staff education level.	Cohen & Levinthal (2015);Tsai (2001); Todorova et Durisin (2007), Huang et al (2015).
		- Combinative capabilities	- Cross-functional interface (interchange) - Socialization mechanisms - Relational embeddedness and relational empowerment - Structure flexibility, decentralization.	Van Den Bosch et al., (1999) ; Iyengar et al.(2015), Jansen et al., (2005), Flatten et al. (2011) ; Pradana et al (2019); Mokhlis et al. (2019 a).
		- Relational capital	- Intensity and quality of partnership relationships (trust, exchange of information and knowledge) - Similarity between partner's organizational structures, common language. - Familiarity with organizational problems	Lane & Lubatkin (1998); Tsai (2006); Murovec & Prodan (2009); Volberda et al. (2010); Mokhlis (2014).
- Transformation	- Internalization - Conversion - Adaptation - Recoding	- Combinative capabilities: (Coordination and socialization capabilities)	- Cross-functional interface (interchange) connectedness - Socialization tactics - formalization, routinization - Number of scientific publications - Structure flexibility , decentralization	Van den Bosch et al (2005); Zahra et George (2002); Jansen et al. (2005), Camisón and Forés (2010); Flatten et al, (2011); Pradana et al, (2019).

		- Relational network external of the firm	- The percentage of hared research communities. - Extent of knowledge transfer partnership. - Support from parent company	Lane et al. (2001); Tsai (2006), Phan et al., (2006);Volberda et al. (2010); Mokhlis (2014).
- Exploitation	- Use - Application	- Combinative capabilities - Social capital - Relational capital (Support from partners).	- Number of publications - Number of patents, - Number of new products / services developed related to Research activity - Extent of knowledge transfer partnership. - The degree of achievement of the organization's goals the quality of services, customer satisfaction and the degree of service success.	Ebers & Maurer (2014); Minh Yung (2017); George et al., (2001), Camisón & Forés (2010), Flatten et al.(2011), Pradana (2019);Schweisfurth & Raasch (2018);Wu & Voss (2015); Mokhlis(2014).Lichtenthaler's (2009) ; De Jong and Freel(2010).

Source: Authors elaboration.

3.5. Organizational outputs of absorptive capacity

Several research studies have highlighted the results of absorptive capacity in terms of new product development, innovative activities, performance or strategic renewal [29]-[35]-[36]-[37], responsiveness [28], international performance and competitive advantage, through enhancing knowledge bases in firms [38]. This capacity is essential for integrating external knowledge and stimulating innovation processes [13].

"Ref. [15]" argued that, in a context of strategic alliance portfolios, the structure of the alliance and the absorptive capacity of the partners influence the performance of the company. A study conducted by [26] analyzed the link between absorptive capacity, innovation and performance via the network position. They conducted a quantitative study on a sample of 120 respondents from 24 units specializing in petrochemicals and 36 units specializing in agro-food. The results showed that the absorptive capacity has a positive effect on the innovation of the units and their performance while the knowledge is easily accessible (via the network).

In carrying out a comparative study on innovative and imitative companies, "Ref. [39]" stated that innovative companies have much more extensive learning capacities than imitative companies. In addition, they highlighted a positive link between the capacity for innovation and the capacity for absorbing knowledge. "Ref. [35]" study examined the relationship between absorptive capacity and the performance of new product development programs, using a large-scale survey. The results showed that the more turbulent the technological and competitive environments, stronger will be the influence for absorptive capacity on new product development. Similarly, "Ref. [19]" underlined that R&D investment through enhancing ACAP increases the innovative capacity of the firms.

Based on data from a survey of a Dutch sample of 316 small high-tech companies, engaged in 1245 collaborations, "Ref. [36]" examined the role of absorptive capacity in expanding the scope of collaboration-related innovation in small high-tech firms. Their results highlighted the role of absorptive capacity in innovative collaborations in high-tech SMEs. They concluded that specific efforts must be made by managers to develop the absorptive capacity of their firms. Noblet et al. (2011) [40] have confirmed that the ACAP process promotes change, develops knowledge and increases resources. "Ref. [32]" demonstrated that social capital through improving ACAP develops the firm's innovative performance. Similarly, the results of the study carried out by [41], through a sample of 138 R&D employees from a multinational electronics company, showed that the two sub-dimensions of absorption capacity, influence directly innovative behavior of R&D employees. The qualitative study conducted by [18], showed that the capability to exploit the external knowledge of health biotechnology companies is positively associated with their capability to create new

products and new processes, and improve their existing products processes. More recently, the results of a study carried out by [42], of 864 employees of an appliance company, showed that absorptive capacity is positively and strongly associated with employee innovativeness.

4. Discussion and proposals for future research directions

This literature review revealed that despite the significant contributions provides by prior research, some limitations persist. We'll present these limits, and then we'll formulate future research directions.

4.1. Difficulties in conceptualizing and measuring this concept

Despite a relatively unanimous consensus of researchers around the multidimensional nature of ACAP [15]-[44] - [8], the majority of empirical studies have not systematically used the absorptive capacity dimensions as established in its theoretical reference models [4]. Similarly, the measurement of absorption capacity seems to be questionable. To measure this construction, its antecedents have often been used. We can distinguish two important perspectives adopted to define and measure ACAP. Some researchers consider ACAP as a static resource and use for example: R&D expenditure as a percentage of sales, level of staff training, number of patents, as a proxy for ACAP. But these variables are also part of previous prior knowledge related (see Table 1) and give little indications about resulting changes in capabilities [14].These difficulties prompted another group of scholars to challenge this perspective recently by adopting a capability-based approach [5] - [10] - [16] - [11]. This group supports that proxies consider ACAP as a static resource rather than capacity. Furthermore, these proxies do not represent the complexity of this capability's dimensions and limit ACAP development to RD contexts [4] - [39].

To overcome these limitations, several efforts to revisit and operationalize ACAP were made. "Ref. [10]" defined ACAP as a dynamic capability that influences and maintains the firm's competitive advantage. They identified complementary capabilities such as potential and realized capabilities. These capacities have been the subject of numerous empirical studies that have attempted to measure them [5] - [12] - [11] - [31].Thus, we can conclude that there was no general consensus on the operational measures of ACAP. Moreover, the debate provoked by the work of [8], concerning the configuration of the dimensions of ACAP, highlighted the ambiguous character, the vagueness of this concept and the difficulty of its measurement.

Future research should focus more on the development of conceptualization and the measurement of this concept. Methods for measuring absorptive capacity should clearly differentiate between measurement of construction and measurement of its antecedents and results. In addition, it would benefit from proposing operational measures that take into account the multi-dimensional nature of this concept. The development of conceptualization may also be stimulated, by a strong emphasis on the efforts, to construct models likely to promote the emergence of multi-level theories and to highlight different aspects of absorption.

4.2. Predominance of quantitative studies, focus on "Content" of knowledge at the expense of "Processes", "It systems" and "Context" of their integration.

Existing empirical work assumed that firms build absorptive capacity based on potentially useful external knowledge. The mere existence of these is a necessary condition, but not sufficient for the firm to develop its absorptive capacity [4] - [12].This work implied that there are few variations between companies in terms of their knowledge management processes and that the company can therefore ignore these processes when studying the value creation. Furthermore, the focus of work on the content of knowledge to the detriment of learning processes and IT systems has contributed to a relative lack of normative models for absorptive capacity management. This has led to a reification of this concept [4]. The little attention paid to the process aspect of absorptive capacity has also led researchers to ignore the contribution of individuals in the development of absorptive capacity. This is distressing because neglecting the contribution of individuals in absorptive capacity models suggests that they are not important in the process of knowledge integration, transfer, and exploitation.

For their part, "Ref. [34]", asserted that the limits of the concept are linked to the predominance of quantitative studies. Which are more appropriate for testing, rather than developing theory. By analyzing the absorptive process in five cases of companies in the health biotechnology sector, the qualitative study conducted by [18], concluded that a processual approach of absorptive capacity must take into account the role of leadership, relational capital, and cognitive capacities on the one hand, the characteristics of organizational structure, the combinative capabilities and IT systems used and the inertia effects linked to coordination mechanisms on the other hand. This finding suggests that significant contributions are much more likely to be added if contextual and qualitative methods are used to analyze ACAP.

Recent studies have recently argued that the firm's ability to exploit and enhance its ACAP is dependent on the extent to which companies are exposed to new external knowledge. However, little is known about how firms in less intuitive contexts can develop and use their ACAP more efficiently. This suggests that future studies should explore ACAP in non-R&D contexts [34]. Finally, these findings offer opportunities that future research attempts exploit by adopting qualitative and quantitative methods, and by studying ACAP in various organizational contexts.

5. Conclusions

The main contribution of this article is to improve our understanding of absorptive capacity. We have tried to capture the complexity and richness of this concept, by approaching in particular its different definitions, its dimensions, its antecedents and its organizational outputs. Our analysis of these elements reveals many achievements, but also some gaps. Future studies would benefit from adopting a multidimensional and processual approach that relies on the thorough analysis of knowledge integration processes and the contextual conditions for their absorption. These searches should also focus on IT systems which provide a storage structure, facilitate the explicit integration of collective knowledge and its sharing through the structure provided by user communities.

In addition, the capacity to absorb knowledge can change over time, so its success assessed over time. It would be interesting to analyze the ACAP processes over time through longitudinal studies. The development of dynamic models to explain the evolution over time of a firm's absorptive capacity, will also lead to new progress. These future research directions will enrich the literature and improve our understanding of this concept.

References

[1] I. Nonaka, and H.Takeuchi, The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation , Oxford University Press, New York, 1995.

[2] B. Kogut and U. Zander, "Knowledge of the firm and the evolutionary theory of the multinational corporation", *Journal of International Business Studies,* Vol. 34, pp: 495–497, 2003.

[3] W.M. Cohen, D. A. Levinthal, "Absorptive capacity: a new perspective on learning and innovation**"**, *Administrative Science Quarterly,* Vol. 35, pp.128-152, 1990.

[4] P.J.Lane, B.R. Koka and S. Pathak, "The re-identification of absorptive capacity: A critical review and rejuvenation of the construct"**,** *Academy of Management Review,* Vol. 31, no. 4, pp: 833–863, 2006.

[5] T. C. Flatten, A. Engelen, S. A., Zahra, and M. Brettel, "A measure of absorptive capacity: Scale development and validation", *European Management Journal*, Vol.29, no.2, pp: 98–116, 2011.

[6] H. F. Hsieh and S.E.Shannon, "Three approaches to qualitative content analysis"**,** *Qualitative Health Research,* Vol.15, no.9, 2005, pp: 1277-1288.

[7] J.H. Adler. Absorptive capacity: the concept and its determinants, Washington: Brookings Institution, 1965.

[8] G., Todorova, & B. Durisin, "Absorptive capacity: Valuing a reconceptualisation"**,** *Academy of Management Review*, Vol.32, no.3, pp: 774–786, 2007.

[9] D. Minbaeva, T. Pedersen, I. Björkman, C.F. Fey and H.J. Park, "MNC knowledge transfer, subsidiary absorptive capacity and HRM", *Journal of International Business Studies*, Vol.34, no.6, p.586-599, 2003.

[10] S.A. Zahra and G. George, (2002). "Absorptive capacity: A review, reconceptualization, and extension". *Academy of Management Review*, Vol.27, no.2, pp: 185–203, 2002.

[11] J. J. Jansen, F. A Van Den Bosch, and H. W. Volberda, "Managing potential and realized absorptive capacity: How do organizational antecedents matter?", The *Academy of Management Journal*, Vol.48, no: 6, pp: 999–1015, 2005.

[12] M. Pradana, A.Pérez-Luño and M.Fuentes-Blasco, "Revisiting Measure of Absorptive Capacity: Applying the Scales in Spanish Wine Industry", *Journal of Management Information & Decision Sciences*, Vol.22, no: 4, pp: 515–526, 2019.

[13] W.M. Cohen, D. A. Levinthal, "Innovation and learning: the two faces of R&D", *Economic Journal*, Vol.125, no.583, pp. 546-573, 2015.

[14] P. J, Lane and M. Lubatkin. "Relative absorptive capacity and inter-organizational learning"**,** *Strategic Management Journal*, Vol.19, no: 5, pp: 461–477, 1998.

[15] G. George, S. A., Zahra, K. K. Wheatley, and R. Khan, "The effects of alliance portfolio characteristics and absorptive capacity on performance: A study of biotechnology firms"**,** *The Journal of High Technology Management Research*, Vol.12, no.2, pp: 205–226, 2001.

[16] F.A.J.Van den Bosch, R.Van Wijk and H.W. Volberda, Absorptive Capacity: Antecedents, Models, and Outcomes, In M. Eaterby-Smith et M. Lyles (dir.), Handbook of Organizational Learning and Knowledge Management Oxford: Blackwell Publishing, 2005, pp: 278-301.

[17] T.T. Phan Anha, C. Christopher Baughn , N. T M. Hanga , K. E. Neupert, "Knowledge acquisition from foreign parents in international joint ventures : An empirical study in Vietnam", *International Business Review*, 15, pp: 463–487, 2006.

[18] C.E Mokhlis, (2014), "Capacité d'absorption des connaissances et apprentissage organisationnel (Application à cinq entreprises du secteur des biotechnologies de santé)", Doctoral thesis, under the supervision of, Jacques Liouville, EM Strasbourg Business School, Strasbourg University,580p.

[19] K. F. Huang, K.H. Lin, L. Y. Wu and P. H. Yu, "Absorptive capacity and autonomous R&D climate roles in firm innovation"**,** *Journal of Business Research*, Vol. 68, no.1, pp: 87-94. 2015.

[20] S. C. Schleimer and T. Pedersen,"The driving forces of subsidiary absorptive capacity", *Journal of Management Studies*, Vol.50, no.4, pp: 646–672, 2013.

[21] M. Ebers, and I. Maurer, "Connections count: How relational embeddedness and relational empowerment foster absorptive capacity"**,** ***Research Policy***, Vol. 43, no. 2, pp: 318-332, 2014.

[22] K. Iyengar, J. R. Sweeney and R. Montealegre, "Information technology use as a learning mechanism: the impact of IT use on knowledge transfer effectiveness, absorptive capacity, and franchisee performance", *MIS Q*, Vol. 39, no. 3, pp: 615-641, 2015.

[23] J. Backmann, M. Hoegl, and J. L. Cordery, "Soaking It Up: Absorptive Capacity in Interorganizational New Product Development Teams"**,** *Journal of Product Innovation Management*, Vol. 32, no.6, pp : 861-877, 2015.

[24] C.E. Mokhlis, A. Elmortada, S. Marwane, "Diagnosis of organizational change: A multi-level approach (Case study of a French SME certified ISO 9001)", *Periodicals of Engineering and Natural Sciences*, Vol. 7, no. 2, pp: 932-943, 2019 a.

[25] A. Daghfous. "Absorptive Capacity and the Implementation of Knowledge-Intensive Best Practices", *SAM Advanced Management Journal*, Vol. 69, no. 2, pp. 21-27, 2004.

[26] W. Tsai, "Knowledge transfer in intra-organizational networks: Effects of network position and absorptive capacity on business unit innovation and performance", *Academy of Management Journal*, Vol.44, no.5, pp: 996–1004, 2001.

[27] C.E Mokhlis, A. Elmortada, M. Sbihi., K. Mokhlis, "The impact of ISO 9001 Quality Management on organizational learning and innovation: Proposal for a conceptual framework"**,** *Periodicals of Engineering and Natural Sciences*, Vol.7, no: 2, pp: 944-951, 2019b.

[28] J. Liao, H. Welsch, M. Stoica, "Organizational absorptive capacity and responsiveness: an empirical investigation of growth oriented SMEs", *Entrepreneurship Theory and Practice*, Vol.28, no: 1, pp: 63-85, 2003.

[29] A. Arbussa, and G.Coenders, "Innovation activities, use of appropriation instruments and absorptive capacity: evidence from Spanish firms", *Research Policy*, Vol. 36, no. 10, pp. 1545–1558, 2007.

[30] Y.C.Tsai (2006), "Effect of Social Capital and Absorptive Capability on Innovation in Internet Marketing", *International Journal of Management*, Vol.23, no.1, pp: 157-166.

[31] C., Camisón and B. Forés**,** "Knowledge absorptive capacity: New insights for its conceptualization and measurement", *Journal of Business Research*, Vol. 63, no: 7, pp: 707-715, 2010.

[32] M. Hughes, R. E. Morgan, R. D. Ireland, & P. Hughes, "Social capital and learning advantages: A problem of absorptive capacity"**.** *Strategic Entrepreneurship Journal*, Vol.8, no: 3, pp: 214-233, 2014.

[33] M. Ebers and I. Maurer, "Connections count: How relational embeddedness and relational empowerment foster absorptive capacity", *Research Policy*, Vol.43, no. 2, pp: 318-332, 2014.

[34] H. W. Volberda, N. J., Foss, and M. A. Lyles, "Perspective-Absorbing the concept of absorptive capacity: How to realize its potential in the organization field"**.** *Organization Science*, Vol.21, no.4, pp: 931-951, 2010.

[35] U.Lichtenthaler and E.Lichtenthaler,"A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity". *Journal of Management Studies*, Vol.46, no.8, pp: 1315–1338, 2009.

[36] J. P. J. De Jong and M. Freel, "Absorptive capacity and the reach of collaboration in high technology small firms", *Research Policy*, Vol.39, no.1, pp: 47–54, 2010.

[37] K.F. Huang, K.H. Lin, L.Y.Wu and P. H. Yu, "Absorptive capacity and autonomous R&D climate roles in firm innovation. Journal of Business Research", Vol. *68, No.1*, pp: 87-94, 2015.

[38] A. Wu, and H. Voss, "When does absorptive capacity matter for international performance of firms? Evidence from China"**.** *International Business Review*, Vol.24, no.2, pp: 344-351, 2015.

[39] A.Y.Lewin, S.Massini, and C.Peeters. "Micro-foundations of internal and external absorptive capacity routines", *Organization Science*, Vol.22, no: 1, pp: 81–98, 2011.

[40] J. P. Noblet, E. Simon, and Parent, R. "Absorptive capacity: a proposed operationalization". *Knowledge Management Research & Practice*, Vol.9, no: 4, pp: 367-377, 2011.

[41] M. Kang, M.J.Lee. "Absorptive capacity, knowledge sharing, and innovative behaviour of R&D employees Technology", *Analysis & Strategic Management*, Vol.29, no. 2, pp: 219-232, 2017.

[42] T. G. Schweisfurth and C. Raasch,"Absorptive capacity T. G., for need knowledge: Antecedents and effects for employee innovativeness", *Research Policy*, Vol.47, no.4, 687–699, 2018.

[43] M. Eaterby-Smith, "Absorptive Capacity: A process perspective", *Management Learning*, Vol.39, no.5, pp: 483-501, 2008.

[44] S. A. Zahra, and G. George, Absorptive Capacity and the Entrepreneurial Process**,** Wiley Encyclopedia of Management, pp: 1-3, 2015.